# The Economic Impact of the Trans-Pacific Partnership: What Have We Learned from CGE Simulation?

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**Abstract**

The Trans-Pacific-Partnership (TPP) trade agreement, if were it to be successfully implemented, would be one of the largest regional agreements ever seen. The possibility of a comprehensive trade agreement spanning the Pacific raises a number of important quantitative questions. One of the most widely used techniques for evaluating the economic impact of regional trading agreements is numerical simulation with computable general equilibrium, or CGE, models. There have now been a large number of papers written that use CGE methods to analyze the potential economic impact of the TPP agreement under varying theoretical and policy assumptions. In this paper we provide a synthesis of the key results that have emerged from the literature, and discuss some new simulation results of our own.

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# 1 Introduction

The Trans-Pacific-Partnership (TPP) agreement, as originally conceived, would be among the largest and most comprehensive free trade agreements (FTAs) ever seen. Together the 12 original TPP member economies (Australia, New Zealand, Japan, Brunei, Malaysia, Singapore, Vietnam, US, Canada, Mexico, Chile and Peru) generate 36 percent of the value of global production, and over a quarter of world trade. Providing rationalization and intensification of a substantial part of the "noodle bowl" of overlapping and intersecting FTAs that have expanded among countries of the Asia-Pacific, the TPP would not only liberalize trade barriers on goods and services and free up investment flows, but would also enhance trade facilitation, encourage the development of production and supply chains, strengthen intellectual property provisions, and make provisions for investor-state arbitration.[1]

The ultimate prospects for the TPP remain unclear. It was dealt a significant blow in January 2017, when the US indicated that it would withdraw from the agreement, and instead pursue bilateral FTAs. Other TPP members, notably Australia and New Zealand, have stated their intention to press ahead without the US. The controversy and uncertainty surrounding such a far-reaching agreement raises important quantitative questions. What is the likely magnitude of the economic gains from the TPP as envisaged? How dependent are those gains on the details of the agreement? How do the gains compare to other proposals? Are they evenly distributed across member economies and across societies within the members? How would the TPP affect non-members, especially the least developed economies? What are the consequences of expanding the TPP, or of members dropping out? What types of changes might we observe in the pattern of economic activity in the member economies? This list is not exhaustive.

One of the most widely used techniques for evaluating the potential economic implications of large scale changes in trade policy is computable general equilibrium, or CGE, modeling. General equilibrium is the branch of economics concerned with the simultaneous determination of prices and quantities in multiple inter-connected markets. CGE models are numerical simulations built on general equilibrium principles, designed with the objective of turning the theory into a practical tool of policy analysis. While the approach has its strengths and weaknesses (and its detractors, see Kehoe, 2003), it has proven a useful tool for the *ex-ante* analysis of trade policy. CGE models are multi-sectoral, often multi-regional, flexible, and logically consistent. Designed to track linkages across an economic system, they are well-suited to examining the economy-wide implications of large changes in the economic environment, and/or changes that affect multiple parts of the economic system at the same time.[2]

[1] The TPP began when Singapore, Chile, New Zealand and Brunei-Darussalam formed the Trans-Pacific Strategic Economic Partnership (TPSEP). In 2008, the US identified TPSEP as an expedient entry point for the trade element of its pivot to Asia, and in 2010 TPP negotiations were launched with Australia and Peru. Malaysia and Vietnam joined soon after. Canada and Mexico joined in 2011 and Japan in 2013, the latter after a ferocious three-year domestic debate, primarily over the implications of the TPP for Japanese agriculture. The agreement was concluded in October 2015.

[2] Applications of CGE to trade policy are numerous. See Scollay and Gilbert (2000) for APEC, Gilbert and Wahl (2002) for Chinese trade reform, Bekkers and Rojas-Romagosa (2016) for the TTIP, and Robinson and Thierfelder (2002) and Lloyd and MacLaren (2004), for more general overviews of regional trade agreements. Also see the meta-analysis of Hess and von Cramon-Taubadel (2008). Introductions to the structure of typical CGE models include Hosoe et al. (2010) and

There have now been a large number of studies written that use CGE methods to analyze the TPP (around 40 of which we are aware). In this paper we provide a comprehensive survey of the existing studies, and a synthesis of the key results that have emerged. The information should be useful to both policymakers looking to evaluate key themes and contextualize results from what is now a substantial body of literature, and to researchers in the area looking both to compare their results to existing work and to identify gaps that new research may gainfully address.

We also provide some new simulation results of our own. In particular, we examine the trade liberalization component of the TPP in comparison to two other major trade agreements: the Regional Comprehensive Economic Partnership (RCEP) and the Free Trade Area of the Asia-Pacific (FTAAP).[3] We also consider the implications of excluding 'sensitive' products from the TPP agreement, of possible expansions of the TPP to include countries which have expressed an interest in joining at a future date, and of the withdrawal of the US from the agreement. Our simulations are among the first to utilize the GTAP9 database, with its substantially updated data and improved regional coverage.[4] They are also among the first to have tariff and TRQ liberalization scenarios constructed from a detailed examination of the actual agreement.

In the following section we provide a broad overview of the CGE work on the TPP. We next consider the results of the models, organized thematically. Our own new simulation results are used throughout to anchor the discussion. The final section contains concluding comments and suggestions for future work. In the appendix we present a table summarizing the studies, key model features, and results.

## 2 Overview of the Modeling Approaches

CGE studies of the TPP have adopted a range of theoretical structures, data, and simulation design strategies. By far the most common theoretical structure is the GTAP model described in Hertel (1997), which is used in its base form in around half of the studies, and in a modified form in several more. GTAP is a multi-regional model that is in widespread use, hence we dispense with a detailed description. In brief, it is a static, perfectly competitive, Armington global trade model.

Within the GTAP-based studies, most assume fixed factor supplies and variable factor prices. Kawasaki (2014) and Whittaker et al. (2013) allow for capital accumulation effects. Narayanan and Sharma (2016) allow for unemployment of labor. Several papers modify the underlying theory of GTAP. Changes range from minor, as in Whittaker et al. (2013), who allow for regional variation in key parameters, and Cabinet Secretariat (2015) and USITC (2016), who introduce an elastic labor supply, to the more substantive changes in Akgul et al. (2015), who introduce firm heterogeneity in an interesting proof of concept. Ex-

Gilbert and Tower (2013). An overview of recent developments is Dixon and Jorgenson (2013).

[3] The former aims to consolidate and deepen trade liberalization among the economies of ASEAN and those economies with which ASEAN already has a plurilateral trade agreement (i.e., Australia, New Zealand, Japan, South Korea, China and India), while the latter is conceived as an FTA among all 21 member economies of APEC.

[4] See also Nguyen et al. (2015), Petri et al. (2012) and USITC (2016).

amples of linking GTAP results to other models, include Ganesh-Kumar and Chatterjee (2014), who use the World Bank's POVCAL tool in conjunction with CGE simulation to assess poverty impacts.

Ciuriak and Xiao (2014) use a modified version of the GTAP model with recursive dynamics and a treatment of FDI. The approach is similar to that of the GTAPDyn model described in Ianchovichina and McDougall (2001), and utilized in several studies (Cheong and Tongzon, 2013, Itakura and Lee, 2012, Lee and Itakura, 2013, and Lee and Itakura, 2014, Strutt et al., 2015). USITC (2016) also uses a recursive dynamic version of GTAP. The PEP model used by Cororaton and Orden (2015), the MIRAGE model used in Disdier et al. (2016), and the model employed by Li (2014), are other examples of applications of recursive dynamic models with a competitive Armington structure.

In other innovations, Li and Whalley (2014) employ an Armington-type model, but introduce money and generalized trade costs (see also Li et al., 2014). In a well-known series of studies (Petri et al., 2012, Petri, 2013, Petri et al., 2013 and Petri et al., 2014, Petri and Plummer, 2016 and Lakatos et al., 2016), the framework of Zhai (2008) is adopted. This model introduces monopolistic competition into manufactures production, and allows for firm heterogeneity. The model is able to capture potential trade changes at both the intensive and extensive margin. Roh and Oh (2016) also introduce firm heterogeneity.

The base data for almost all of the studies is GTAP. For computational purposes, it is generally aggregated. The level of regional and commodity detail ranges from 'toy' models with 3 regions $\times$ 2 commodities (Akgul et al., 2015) to models with 27 regions (Li, 2014) and up to 57 commodities (Ciuriak and Xiao, 2014), with most in the range of 20-25 regions and commodities. The regional aggregations are focused on the Asia-Pacific for obvious reasons, and the commodity aggregation often emphasizes agriculture. The earliest studies were based on GTAP7 data, with a base year of 2004 (Areerat et al., 2012, Itakura and Lee, 2012, and Oduncu et al., 2014), while most of the remainder use GTAP8, with a base year of 2007. The work of Nguyen et al. (2015), Petri and Plummer (2016) (see also the extended discussion in Lakatos et al., 2016), Cabinet Secretariat (2015), and USITC (2016), along with this paper, use the more recent GTAP9 database, which has a base year of 2011.

Despite the consistency in the primary data source, there is a lot of variation in terms of modifications. Several of the static models update the data to a more recent base year (Kawasaki, 2014, USITC, 2016) or project the equilibrium forward to the presumed time of liberalization (e.g., 2020 in the case of Whittaker et al., 2013, and 2025 for Burfisher et al., 2014). The recursive dynamic studies, by design, all develop baselines going out as far as 2030 (Itakura and Lee, 2012 and Petri and Plummer, 2016) and even 2047 (USITC, 2016). A number of studies incorporate information on other FTAs that have already been agreed upon (e.g., Cheong and Tongzon, 2013, Disdier et al., 2016, Narayanan and Sharma, 2016, Petri et al., 2012, Petri and Plummer, 2016). Several studies incorporate information on NTBs from various sources into the base data (Cororaton and Orden, 2015, Disdier et al., 2016, Itakura and Lee, 2012, Lee and Itakura, 2013, Lee and Itakura, 2014, Li and Whalley, 2014, Petri et al., 2012, Cabinet

Secretariat, 2015, Petri and Plummer, 2016 and USITC, 2016). Other more unusual data adjustments include modifications to certain behavioral parameters in Japanese agriculture in Whittaker et al. (2013), and a split of the data to account for SEZs in China and Mexico in Li (2014).

The degree of trade liberalization in the TPP has only recently become known with certainty. Hence, we see a variety of shock assumptions. Most studies focus squarely on trade reform. The most common simulation is a removal of all intra-TPP tariffs across the 12 TPP members.[5] While not very realistic, this is a useful benchmark. Other studies consider limited liberalization scenarios. Cororaton and Orden (2015) assume tariffs are reduced by 90 percent, Durongkaveroj et al. (2014) considers a case where agricultural tariffs are cut by only 50 percent. Both Ciuriak and Xiao (2014) and Petri et al. (2012) design best guess scenarios based on the contents of other agreements. These studies also make adjustments for under-utilization of tariff preferences. A few studies consider liberalization only in a subset of sectors. Burfisher et al. (2014) consider agriculture and agrifood products, while Lu (2015) focuses on textiles and apparel reform. Only the very recently released studies of Cabinet Secretariat (2015), Petri and Plummer (2016) and USITC (2016), along with this paper, have tried to match the actual agreement.

Several papers make additional assumptions about NTB cuts (see for example Burfisher et al., 2014, Ciuriak and Xiao, 2014, Cororaton and Orden, 2015, Nguyen et al., 2015, Strutt et al., 2015, Cabinet Secretariat (2015), and Disdier et al., 2016, among others). NTB shocks are designed as removal of tariff equivalents and/or shocks to import augmenting technological change, and range from cuts of 20 percent to complete removal. In some cases the removal is assumed to spillover to non-member countries (Petri and Plummer, 2016). Burfisher et al. (2014) explicitly model TRQs in agriculture and their removal, as do USITC (2016). Some studies also introduce productivity shocks in Japanese agriculture into the simulations (Whittaker et al., 2013, and Lee and Itakura, 2014).

For the new simulations in this paper we have adopted a modified version of the GTAP model. Following Whittaker et al. (2013), we allow both the degree of mobility of land across agricultural uses and substitutability between domestic and foreign versions of the same product to vary by country. The closures we use are medium and long run (i.e., capital mobile across sectors but in fixed total supply, and capital variable to maintain fixed real returns, or a steady-state closure).

The data that we have employed is GTAP9. We have aggregated the country data to a total of 27 regions, individually identifying TPP members and potential members, along with major trading partners grouped geographically. We have 32 sectors, with some detail on agricultural/food products reflecting the controversial role they played in the negotiations. We have also made some adjustments to the behavioral data following Whittaker et al. (2013). In particular, we have adjusted the mobility of land in Japan downward to reflect the view that agricultural land use is not as flexible in Japan as in other countries.

[5] Some early studies, such as Areerat et al., 2012, Suzuki, 2012, Takamasu and Xi, 2012, Li and Whalley, 2014, and Petri et al., 2012, which were designed before the TPP expanded to include Canada, Mexico and/or Japan, include only a subset of TPP members.

We have also reduced the Armington elasticity in Japan for some products (notably rice, but also some other agricultural commodities) to reflect the view that domestic versions of these products are seen by Japanese consumers as less substitutable for foreign versions than in other countries.

We consider seven scenarios. In the first, we simulate the effect of the TPP, incorporating the tariff and tariff rate quota (TRQ) provisions in the agreement. The shocks were constructed from a detailed analysis of the TPP agreement text and schedules, mapped onto the GTAP database.[6] TRQ expansions are modeled as the equivalent tariff cuts that generate the indicated import expansion (as in Strutt et al., 2015). For comparison purposes we also consider the complete removal of tariff barriers among the 12 member economies, leaving tariffs applied to non-members intact. We then consider two expansions of the TPP, with a scenario introducing 'probables' followed by 'possibles', and a contraction – the exit of the US from the agreement. Finally, as a point of comparison, we consider the implementation of the RCEP and FTAAP, modeled as the complete removal of tariff barriers among the member countries.

# 3 Results and Implications

## 3.1 How Large are the Potential Gains from the TPP?

Our estimates of the total welfare gains based on the liberalization measures agreed (presented in Table 1), are in the range of $15 billion in the medium run, and just over $38 billion in the long run.[7] Approximately $7 billion and $5 billion of the total gains come from movement of the terms of trade against non-TPP countries, in the medium and long run, respectively. Using the steady-state closure generates an estimate of roughly $18 billion in capital accumulation gains in the long run. The remainder of the effect is composed of gains in allocative efficiency (i.e., improvements in resource allocation).

There is a large range in the estimates of total gains in the literature, and our results are at the conservative end. Rahman and Ara (2015) estimate $11 billion and Areerat et al. (2012) estimate $14 billion. At the high end, Petri et al. (2012) estimate $285 billion, and Kawasaki (2014) provides an upper bound figure of $449 billion. The most recent study by Petri and Plummer (2016) puts the gain at $465 billion. Most of the estimates fall in the $50-150 billion range.

[6] Only four members (Australia, Brunei, New Zealand and Singapore) retain no exclusions or exceptions. Almost all the exclusions and exceptions are in agriculture and food, with sugar and dairy the most heavily impacted. Mexico and Vietnam retain some restrictions on motor vehicles. Japan has by far the most extensive and most significant exclusions and exceptions, affecting over 300 tariff lines. In addition to sugar and dairy products, rice, wheat and some other grains are heavily excluded, and substantial restrictions remain on meats and a wide range of processed food products. In many cases agricultural market access is through TRQs. Some are country-specific while others are TPP-wide. In other cases tariffs on sensitive agricultural products remain at MFN levels, or are reduced but not eliminated, as with beef by Japan. There appear to be cases where market access provisions discriminate between TPP members on the basis of their degree of competitiveness, with tariffs largely maintained on imports from the most competitive suppliers but removed on imports from other TPP members. In other cases discrimination appears to be based on reciprocity considerations.

[7] These are measured using the equivalent variation in household income, and can be interpreted as the permanent annual increase in regional household income at constant prices. An approximation of the total gains is the discounted value of the stream of annual gains. Using this method Petri and Plummer (2016) put the total gains (assuming entry into force in 2017) at between $3 and $9 trillion. Using the same discount rates the corresponding numbers from our long run estimates would be $0.6 to $1.6 trillion.

What are we to make of the variance? On the one hand, there are some reasons to think that models may be overstating the gains. Probably most importantly, aggregate welfare gains are increasing in the size of assumed the tariff cuts. Studies that consider more limited tariff cuts either in terms of depth or breadth of coverage, or because of preference utilization, generate lower welfare estimates all else constant. Many (particularly early) studies assume unrealistically reductions in protection.

To get an idea of how much the results might be overstated by overly optimistic assumptions, consider the results of our full liberalization scenario presented in Table 2. Compared with the results in Table 1, the total estimated gains from complete tariff reform in the TPP are over 50 percent higher in the long and short run. This difference can be interpreted as what is "left on the table" by the exclusions and exemptions in the TPP agreement. Note that the difference is largely seen in allocative efficiency effects (and the associated accumulation in the long run), since aggregate terms of trade movements are similar in both scenarios. The large difference suggests that the carve-outs have come at significant welfare cost.

Other studies consistently confirm that the gains from the TPP are likely considerably lower with sensitive products excluded. Given the challenging nature of agriculture in the TPP negotiations, a number of studies have focused attention on this area (Burfisher et al., 2014; Disdier et al., 2016; Lee and Itakura, 2014; Whittaker et al., 2013). The latter two of these studies focus specifically on the case of Japan. A few other studies, while not focused on agriculture, also consider simulations in which agriculture is excluded (e.g., Durongkaveroj et al., 2014). Not all of these studies report welfare results, but those that do show substantial welfare costs.

Petri et al. (2012) consider a scenario where each country is granted an exemption in their three most sensitive sectors. For Japan, these sectors were rice, wheat and other agriculture, while for the US the sectors were apparel and footwear, textiles, and other agriculture. In these sensitive sectors the assumed tariff cuts are reduced by 2/3. The results are striking – the estimated total welfare gain falls from $110 billion to $78 billion. They conclude that Japan's entry to the TPP is beneficial in the aggregate, but not if it requires concessions that diminish the quality of the agreement.

The latest results from Petri and Plummer (2016), like ours based on the actual agreement, provide some more useful insights. While the overall welfare gains are actually larger than in the earlier study (Petri et al., 2012), the authors very carefully lay out the sources of the differences. They show that much of the increase is explained by changes in the baseline to 2030 from 2025, and updated data on NTBs. The addition of an assumption that the NTB liberalization spills over multilaterally also pushes the estimated welfare gain upward considerably. On the other hand, their estimates of the effect of NTB reform on economic welfare based on the actual agreement, are revised downward significantly.

Upward bias may also come from the 'overestimation' problem (see Cheong and Tongzon, 2013). The economies of the Asia-Pacific region have been at the forefront of the global proliferation of regional trading agreements. Consequently there are numerous overlapping FTAs that have been recently negotiated

among the TPP members and between TPP members and other economies. While agreements that are in place at the time of the base year will be accounted for, those that were agreed (or will be implemented) at a later date are generally not unless the modeler explicitly attempts to do so. While a few do (Cheong and Tongzon, 2013, Ciuriak and Xiao, 2014, Itakura and Lee, 2012, Petri et al., 2012) most do not. Even in those that do make adjustments, it is difficult to account for them all. This is not a problem with the size of the estimated welfare gain per se, but with the attribution of the gain to the TPP.

On the other hand, there are several compelling reasons to think that the economic welfare estimates that come out of CGE studies in general are lower bounds on the actual economic effects of the scenario considered. First, most CGE studies use competitive static models, with relatively high levels of aggregation. These characteristics limit the size of the effects that can be observed. Models that incorporate imperfect competition, such as Petri et al. (2012) and its follow ups, and Roh and Oh (2016), tend to generate significantly larger welfare estimates, ceteris paribus, although as Petri et al. (2012) state, this comes at the expense of increased parametric uncertainty.[8] Similarly, models that capture some aspects of the effects of trade reform on capital accumulation, either through the use of dynamics (Ciuriak and Xiao, 2014, Cheong and Tongzon, 2013, Itakura and Lee, 2012, and others), or through the adoption of a steady state closure (Whittaker et al., 2013, Kawasaki, 2014), also tend to generate larger predicted gains. We see this clearly in our results, where the estimates under the steady state closure are around 2.5 times larger than under a neoclassical factor market closure. Aggregation tends to smooth out the peaks across distortions, but the welfare costs of interventions increase exponentially with the size of the distortions. Hence aggregation also tends to push welfare estimates downward.

Second, many of the effects of trade reform are hard to quantify. Trade reform may spur increases in productivity that likely dwarf the effects of resource allocation. But little is known about the magnitude. Moreover, existing CGE studies have tended to focus on tariff liberalization in merchandise. This is an important part of the TPP, but by no means the only part. It is likely that the gains from liberalization of services, and other aspects of the TPP, such as trade facilitation and improvements in regulatory consistency, would have large economic efficiency effects.[9] Those studies that do incorporate information on NTB reductions in addition to tariff cuts, generate larger estimates.[10] Hence, on balance, while there is much uncertainty, it is probably safe to say that even the estimates at the higher end are probably lower bounds on the true potential welfares gains from the TPP.

[8] Empirical models based on heterogeneous firm trade theory and the gravity model have generated mixed results with respect to the gains from trade reform relative to standard models. See Arkolakis et al. (2012) and Melitz and Redding (2015) for competing views. Scollay and Gilbert (2000) and Gilbert and Wahl (2002) both note that incorporating imperfect competition into CGE models seems to roughly double the estimated welfare gains relative to perfectly competitive models.

[9] On the importance of trade facilitation, Anderson and van Wincoop (2004) give a famous headline estimate of 170% average developed economy trade costs, only 8% of which reflects the direct effects of tariff *and* non-tariff barriers.

[10] Ciuriak and Xiao (2014) is a nice example of decomposing the estimated welfare gains by category of liberalization. Only one quarter of the estimated welfare gain in their best guess scenario (approximately $75 billion) is from tariff liberalization. USITC (2016) has a similar breakdown for the US only. In their estimates approximately 55 percent of the gain to the US is from merchandise trade reform, 35 percent from services trade reform, and 10 percent from FDI reforms.

### 3.2 Distribution of the Gains

Not all members of the TPP are likely to benefit equally from the agreement, and CGE is a useful tool for helping us to assess regional variations. Consider again the results from Table 1, focusing now on the equivalent variation by country. Since the members of the TPP vary considerably in terms of economic size, we provide some context expressing the gains as a percentage of baseline GDP.

In absolute terms, the largest gains in our estimates are to the larger TPP economies. Most notable is the case of Japan, where the estimated welfare gain of over $8 billion in the medium run is more than double the next largest gain (just over $3 billion for Vietnam). The pattern holds in the long run also, where the estimated gains to Japan at $18 billion are roughly four times the next closest country (again Vietnam). Gains to the US are modest, around $3 billion in the long run.[11] While not all of the TPP members are estimated to have positive welfare effects from TPP tariff liberalization in our simulations, any negative outcomes are small. The model predicts very small negative effects for Australia, Mexico and Peru in the medium run, although the signs reverse in the long run.

When viewed relative to GDP, the pattern is quite different from that in the absolute levels. The biggest winners now tend to be the smallest countries. By far the largest proportional gains are estimated to accrue to Vietnam, at 2.4 and 3.7 percent of GDP in the medium and long-run, respectively. Vietnam is followed by Brunei, and, in the long-run, Malaysia. Among the developed economies, the largest gainer in proportional terms is Singapore, with an estimated gain of just under 0.5 percent of GDP.

It is interesting to consider the regional effects of the carve outs by comparing Tables 1 and 2. We see that just four TPP members (Japan, US, Canada and NZ) account for 98 percent of the reduction in the estimated total welfare gains. Japan has by far the largest reduction in EV in absolute terms, amounting to over a third of its welfare gains under full liberalization. This reveals that a large part of the economic gains to Japan from the TPP are associated with its own agricultural trade liberalization. Excluding these products substantially cuts into the economic benefits. The erosion of welfare gains caused by agricultural carve-outs is proportionately even greater for Canada, amounting to over 60 percent of potential gains from full liberalization in both the medium and long run.

Petri et al. (2012) also note that most of the economic damage from exemptions manifests in the economies employing them, and suggest that allowing Japan to make more gradual or modest reductions in its sensitive sectors would not be very costly for its partners. As a counter-example to this suggestion, relative to GDP by far the largest reduction in welfare resulting from the carve-outs in the TPP is recorded for New Zealand. These reductions are overwhelmingly due to terms of trade losses, reflecting the effect on New Zealand exports of the market access restriction on agricultural imports retained by other TPP members, notably Japan and Canada.[12] There may also be concerns over the precedent for

[11] USITC (2016) focuses on the effect of the TPP on the US, putting the total real income gain in the region of $57 billion at 2032, or 0.23 percent of baseline GDP.

[12] Strutt et al. (2015) focus on the impact of the TPP on New Zealand, estimating gains in the region of $0.4 to $1.8 billion, with the higher figures assuming cuts to NTBs.

further liberalization in the region. Most of the TPP members as well as other Asia-Pacific economies have some sectors that are sensitive, and generalizing the practice of carve-outs for these sectors may diminish the eventual prospects for welfare-enhancing reform under an eventual FTAAP. As Petri et al. (2012) note, "allowing exemptions invites rent-seeking and becomes difficult to contain."

The reduction in welfare for the US from the carve-outs is similar to that for Canada in absolute terms. Welfare gains for the US are eliminated in the medium run scenario, and halved in the long run scenario. As with Japan, there are reductions in allocative efficiency, reflecting the extent of agricultural protection retained by the US, but in the US case there are also larger terms of trade losses, presumably reflecting both the market access restrictions on US agricultural exports retained by other TPP members (including Japan and Canada) and probably some degree of preference erosion in NAFTA markets.

Although the estimates of the total welfare gains of the TPP vary considerably, the pattern in the regional distribution of the welfare gains is remarkably consistent across all of the CGE studies that have been completed so far. Most studies predict all TPP members will experience positive welfare gains, or at worst negligible change in economic welfare. There is strong consensus that the largest gains in absolute terms will accrue to Japan, and that the largest proportional gains will accrue to Vietnam.[13] As Petri et al. (2014) note, the TPP has a tendency to be most beneficial to those countries that do not already have an FTA with the US. In fact, we see this result in every study, despite considerable variation in model structure and simulation design (see Areerat et al., 2012, Itakura and Lee, 2012, Petri et al., 2012, and Petri and Plummer, 2016, for examples). Hence, while there is considerable uncertainty over the total magnitude of economic gains, there is much less uncertainty over their regional distribution.

Why is that? Economic theory gives us considerable guidance on which countries are expected to gain the most from an FTA. The distribution of benefits will depend critically on an economy's own initial protection structure (which affects the size of potential gains in allocative efficiency, with more protected economies having more to gain); the size of trade in the economy's GDP, with more trade dependent economies larger beneficiaries of trade liberalization in relative terms; on the barrier they face in partner economies (which will affect the scope of potential expansions); and finally on the strength of their initial trade ties with the partners, which will impact the ability of each economy to take advantage of expanding market opportunities. These factors are economic characteristics reflected in the data of a CGE model, which is basically common across the studies of the TPP, rather than in the theory and shock structure, which varies more. This explains the consistency.

We see confirmation of the importance of the factors described above in the patterns observable in the sources of the welfare gains and how these differ across the various TPP members. New Zealand

[13] Interestingly, Petri and Plummer (2016) have the largest absolute gains accruing to the US, followed closely by Japan. This result is driven by the assumption of multilateral spillover on NTB reform, which seems to benefit the US disproportionately in the simulations. The study by the Japanese Cabinet Secretariat (2015) predicts much larger gains to Japan, around 2.6% in terms of real GDP. That study assumes a strong labor supply response in the Japanese economy, as well as introducing a productivity/trade linkage.

is very open and very trade dependent, and has welfare gains that are comprised almost entirely of terms of trade effects (market access). Its welfare gains are significantly reduced by the market access restrictions of its TPP partners. For Japan, by contrast, most of the gains are from improvements in allocative efficiency, indicating that the primary source of the potential gains for is its own tariff reform. A significant proportion of these gains are foregone by exemptions. For Vietnam, a combination of factors including high initial protection, high dependence on trade within the region, and high barriers faced in certain critical exports sectors where it has a strong comparative advantage, such as textiles, footwear and wearing apparel, lead to large relative gains in both efficiency and the terms of trade.[14]

As a final note, it is interesting to observe that Mexico actually suffers a decline in its terms of trade in our simulations, although the gains in allocative efficiency, and in the long run, capital accumulation, are enough to outweigh those negative effects. This is likely a consequence of a loss of relative preferences within NAFTA as the US market opens to other TPP members. This pattern is exacerbated for Mexico in those studies that factor in the FTA between Japan and Mexico, which entered into force in 2005, and its associated preferences, which will also be eroded by the opening of the Japanese market to other TPP members (i.e., Petri et al., 2012). We discuss this idea further in the next section. Our simulations also show negative term of trade effects for Malaysia, which may be due to the erosion of its preferences in the markets of other ASEAN TPP participants, as the TPP opens these markets to North and Latin American members.

### 3.3 Effects on Non-members

Evaluating the effect of the TPP on non-member economies, in particular small developing economies which are likely to be excluded from not only the TPP but also other major trade agreements, has been a major concern in the literature.[15] In our simulations, we see that in the overall effect on non-member economies is negative (Table 1). Most of the effect on those countries will be felt through the terms of trade. Allocative efficiency changes will occur too, as global prices change the flows of goods and resources across existing distortions in non-member countries, but these effects are of second-order magnitude. Welfare effects resulting from terms of trade changes are zero sum, an overall gain in the terms of trade to TPP members must be reflected in a terms of trade decline for non-members. It is also interesting to note that the total 'world' welfare effect of the TPP is positive, implying that the TPP increases allocative efficiency at the global level.

[14] Petri et al. (2012), which allows for imperfect competition, also note powerful scale effects in Vietnam's principal production clusters. The study by Nguyen et al. (2015), which uses simulations with both a general equilibrium model (GTAP) and a partial equilibrium one (GSIM), focuses on Vietnam and confirms the general pattern. The latter also emphasizes the role of increased investment in the economy.

[15] Rahman and Ara (2015) consider the impact on Nepal and Bangladesh, Cororaton and Orden (2015) the Philippines, and Durongkaveroj et al. (2014) Thailand. The impact on India is examined by Ganesh-Kumar and Chatterjee (2014) and Narayanan and Sharma (2016), while a number of studies have considered impacts on China (Bi et al., 2013, Li and Yao, 2014; Lu, 2015). Turkey is considered by Oduncu et al. (2014), and Brazil is examined in Thorensten and Ferraz (2014).

Which countries are likely to be hurt most by the TPP? Effects on non-members manifest through two closely related mechanisms, trade diversion and preference erosion.[16] These concepts suggest members of preferential trading agreements with TPP members that are not themselves part of the TPP, and least developed economies, both of which would be likely to be impacted by preference erosion, and large, efficient export economies excluded from the agreement, which would be subject to diversion of trade. There are many countries that have FTAs with TPP members but are not themselves a part of the TPP.[17] While the agreements vary in terms of coverage, quality and utilization (see Kawai and Wignaraja, 2011), overall, the existing agreements would tend to suggest we should expect the most negatively affected economies to be the members of ASEAN that are not part of the TPP, along with Korea and China, which are likely to suffer from both preference erosion and trade diversion effects.

This expectation is borne out in our simulations. In Table 1, we observe large economic losses predicted for Korea, China and the members of ASEAN, most notably Thailand, in all cases driven by adverse movements in the terms of trade. In absolute terms the largest loss is to China, at around $4 billion in both the short and long run. This is a small proportion of Chinese GDP, however (only 0.06 percent). China is followed by Western Europe, with estimated losses of approximately $3 billion (0.02 percent of the region's GDP). The proportional impact on Thailand is much greater than other countries, at around -0.4 percent of GDP in both the short and long run. Indeed, Thailand seems to be the economy most at risk from the TPP in its current form.

While the magnitudes of the effects vary, the sign pattern is very consistent across all of the studies. There is general agreement that the economies most hurt in absolute terms will be China, Western Europe, and Korea, and in relative terms Thailand. Useful inferences can be drawn from the studies focusing on effects on specific countries. Durongkaveroj et al. (2014) estimates a fall in Thailand's GDP as a result of the TPP of approximately 0.6 percent. The impact is substantially reduced if agricultural trade reform in the TPP is limited (to 0.4 percent with a 50 percent cut in intra-TPP agricultural tariffs, and 0.3 percent if agriculture is excluded entirely). This suggests that the primary cause of welfare losses in Thailand is increased discrimination in food markets. This is supported by a comparison of the results for Thailand in Tables 1 and 2. The agricultural carve-outs in the agreement actually help Thailand relative to full liberalization, reflecting reduced discrimination against its agricultural exports.

In the case of China, Lu (2015) focuses on attention on the role of textiles liberalization, emphasizing the result that the TPP, while having a small welfare impact on China relative to GDP, will have a

[16] Trade diversion is where a tariff preference causes a switch in the source of imports from a non-member source to a member. From the perspective of the non-member, there will be a loss of market share (a decline in the terms of trade). Preference erosion is where a tariff preference causes a shift in imports away from a partner in a pre-existing agreement to a source in the new (or expanded) agreement. This will again be reflected in a decline in market share.

[17] Notable among these are China and the members of ASEAN excepting Malaysia, Brunei, Singapore and Vietnam. Korea has FTAs with Australia, the US, Chile, Peru, New Zealand and Singapore, as well as with Malaysia, Brunei and Vietnam through its ASEAN agreement, and Canada (as of January 2015). There are agreements between Japan and Thailand, Indonesia, the Philippines and India. Australia's agreement partners include China and Thailand, and also the other ASEAN countries not participating in the TPP. New Zealand has agreements with China, Taiwan and Hong Kong, as well as the other ASEAN countries not participating in the TPP. Mexico has an agreement with the European Union. This list is not exhaustive (and is constantly growing as new agreements proliferate).

substantial impact on China's exports in the textiles/apparel category. They estimate a fall in export value of roughly $2 billion, a figure that is worsened with Japan's decision to enter into the agreement.

For India, Ganesh-Kumar and Chatterjee (2014) and Narayanan and Sharma (2016) find small impacts. The former uses POVCAL in conjunction with CGE simulation, and identifies small increases in poverty and income inequality as a result of the agreement. In both studies the effects on India come about largely through changes in textiles trade. The relatively small magnitude of the economic effects presumably reflects India's relatively limited trade ties to the region. Only around a quarter of India's exports and a fifth of its imports are destined top/sourced from the TPP countries. Rahman and Ara (2015) also note modest welfare declines in South Asia, driven by falls in agricultural and textile exports.

Negative effects of the TPP vis-a-vis non-members may be offset by other agreements. For example, the impact on Western Europe may be partially canceled out by a successful implementation of TTIP, although this now looks unlikely, and other agreements that are being negotiated between the economies of Asia and the European Union (most notably those involving ASEAN and Japan). Similarly, the proliferation of agreements between TPP member states and other non-TPP member states will ameliorate negative effects on non-members (although the rise of numerous overlapping and not always consistent preferential agreements raises a host of other potential concerns, see Menon, 2014.)

### 3.4 Expanding/Contracting the Membership

Non-members can counteract negative effects of the TPP by joining. The TPP has already undergone a number of membership expansions since its humble beginnings as the P4. The current position is that there will be no new members until the agreement enters into force, so new memberships are not imminent. Nonetheless, a number of countries have expressed intent, and still others have expressed informal interest.[18] Hence, many studies have considered the implications of possible future TPP expansion, often in conjunction with simulations investigating the impact of the current agreement on non-members.[19]

[18] The present situation can be summarized as follows. Korea is widely seen as the likely "first cab off the rank." In terms of the rest of East Asia, China conducted an intense study internally in 2013-14 on the implications of joining the TPP, deciding to defer any decision. Joining becomes more feasible if the US is not there to block such a move. Taiwan has definitely indicated interest, but there is a widespread (though not universal) view that it is impossible for Taiwan to join until China does. Hong Kong would also likely join with China, but is unlikely to do so otherwise. In terms of South East Asia, the Philippines has expressed interest but has some constitutional difficulties. Thailand announced an intention to join the TPP, but enthusiasm for accession seems to have declined since the coup, both inside and outside Thailand. Most recently, President Widodo of Indonesia announced an intention to join TPP to President Obama during a visit to Washington. This was apparently a surprise in Jakarta, observers doubt his ability to muster the necessary political support. Finally, outside of APEC, Colombia and Costa Rica (non-APEC members of the Pacific Alliance) have expressed a desire to join TPP, but the understanding is that TPP membership is limited to APEC members for the time being.

[19] The most common scenarios considered in the literature so far are expansion of the TPP agreement to include Korea (Areerat et al., 2012; Bi et al., 2013; Disdier et al., 2016; Itakura and Lee, 2012; Lee and Itakura, 2013; Lee and Itakura, 2014; Narayanan and Sharma, 2016; Petri et al., 2012; Takamasu and Xi, 2012; Petri, 2013; Petri et al., 2013; Petri et al., 2014; and Roh and Oh, 2016), in various configurations, and China (Areerat et al., 2012; Disdier et al., 2016; Li and Whalley, 2014; Li, 2014; Li and Yao, 2014; Narayanan and Sharma, 2016; Takamasu and Xi, 2012; Thorensten and Ferraz, 2014; and Petri et al., 2014). Other countries that have been considered as possible future members in the literature include the Philippines (Cororaton and Orden, 2015; Lee and Itakura, 2014; Petri et al., 2013; and Petri et al., 2014), Thailand (Durongkaveroj et al., 2014; Lee and Itakura (2014); Petri et al., 2013; and Petri et al., 2014), Indonesia (Lee and Itakura, 2014; and Petri et al., 2014), Taiwain (Takamasu and Xi, 2012), India (Disdier et al., 2016; and Narayanan and Sharma, 2016), and the economies of South Asia (Rahman and Ara, 2015).

We divide our own expansion scenarios into two steps. In the first we add to the existing TPP members the most 'probable' new member – Korea. We follow by adding a group of 'possibles'. These are a group of countries where there have been media reports of potential interest in the future, but as yet no 'official' moves toward joining the TPP. This group consists of China, Indonesia and Taiwan. Ultimately, the group of countries seeking to join the TPP may of course be larger still, if it becomes seen as a viable mechanism for reaching an FTAAP. The scenarios assume expansion of tariff preferences to new members on the same basis as for existing members, but new members liberalize fully.

The estimated aggregate welfare impacts are presented in Table **??**. These are the long-run impacts, so the numbers are comparable to the corresponding results in in Table 1.[20] Generally, the larger the regional trade agreement, the greater the potential economic benefits to its members, so we expect the overall welfare gains to be increase as more members are added. Including Korea is indeed estimated have a substantial impact on overall gains, which rise to over $100 billion in the long run, well over double the estimated long-run impact of the TPP without Korea. Most of the difference is in welfare gains to Korea itself, the gain (relative to being excluded from the TPP) being close to $54 billion (4 percent of GDP). This result is confirmed by the existing studies, which consistently show large benefits accruing to Korea from TPP membership. In our simulations the gain is dominated by capital accumulation and allocative efficiency effects. This suggests that while Korea would be among the largest gainers from an expanded TPP in both relative and absolute terms, like Japan, much of the gain is dependent on its own liberalization. Hence, the impact would be substantially diminished if sensitive sectors were to be excluded.

As an FTA expands its membership, existing members generally gain as the potential for trade diversion is reduced. There is the potential for countries to lose from preference erosion, however. According to our simulations, expansion of the TPP to include Korea has a positive impact on estimated net economic welfare for all of the 12 current TPP members. This contrasts with the results of Roh and Oh (2016). While the effects are small in most cases, the estimated effect on Australia is quite substantial.[21] The impact on non-members is generally negative, with the largest impact in relative terms on Thailand.

Expansion to include the 'possibles' has an even more dramatic effect on the size of the estimated total long-run welfare gains to TPP members. As we see in Table **??**, the estimated gain is nearly doubled relative to the inclusion of Korea, and five times that of the TPP12, at over $190 billion. Once again, a large proportion of the gains accrue to the new members themselves. The largest estimated gain is to China, at $39 billion relative to the TPP+Korea scenario, or around 0.6 percent of baseline GDP. As

[20] Since these are comparative static simulations, the difference in the dollar value figures for any pair of scenarios can be interpreted as the additional impact the liberalization under the second scenario, assuming that the first scenario has already been implemented.

[21] This may be an example of the 'overestimation' problem. Since Australia has recently signed agreements with Korea and China, we should interpret the effect on Australia as the joint impact. Expanding the TPP to include Korea and China should be beneficial to Australia only to the extent that it results in a higher degree of liberalization of bilateral trade. New Zealand has also recently signed an agreement with Korea. Similarly, although China and Korea concluded an FTA in late 2014, bringing these two countries into the TPP would benefit them both to the extent of the much higher liberalization involved in the TPP, in addition to the benefits related to their trade with existing TPP members.

with Japan and Korea, this seems to be driven primarily by the effects of China's own liberalization, and would likely be cut substantially by exemptions. The corresponding figures for Taiwan and Indonesia are approximately $7 billion (1.5 percent of baseline GDP) and $4 billion (0.4 percent), respectively.

Adding China to the agreement strongly benefits Japan, Singapore, and Australia. It is also interesting to note that the inclusion of China increases the estimated benefits of the TPP for the US substantially. The work of Li and Whalley (2014) and Li et al. (2014) suggests that inclusion of China in the agreement may also result in a slight improvement in the politically sensitive trade imbalance. Including China would likely have a strong negative welfare effect on Vietnam, however. Although they remain substantial, the expansion cuts the estimated welfare gains to Vietnam by around $3 billion (just over 2 percent of baseline GDP). What we are seeing here is a particularly severe case of preference erosion. Vietnam and China are both large suppliers of textiles, and Vietnam benefits from the reduced competition in an agreement without China. China's entry to the TPP removes that benefit. This is a pattern that has been noted in a number of other studies (see Li, 2014, and Li and Yao, 2014).

Similar results to those involving Korea and China are seen in the other expansion studies. Cororaton and Orden (2015) estimate gains of roughly 1.7 percent of GDP for the Philippines from joining the TPP, relative to being excluded. This includes an assumed benefit from expanded FDI into the Philippines worth 0.2 percent of GDP, in addition to tariff and NTB reform. They argue that the potential benefits to the Philippines are limited by a number of domestic factors, most notably a large infrastructure gap. Durongkaveroj et al. (2014) shows that the benefits to Thailand from joining the TPP are substantial, as it is able to avoid significant trade diversion. They also show, however, that the benefits are strongly dependent on agricultural trade reform being included in the TPP.

While the Philippines and Thailand have a strong incentive to join the TPP to avoid trade diversion effects, this is not the case for India. Narayanan and Sharma (2016) find relatively small impacts on the Indian economy from the TPP. The flipside is that there are also relatively small gains to India from joining an expanded TPP. They estimate gains of around $13 billion from an agreement with both Korea and China, around 1/5 of the gains to China and 1/10 of those to Korea. They conclude that there would be little for India to gain from joining the TPP in the future, in particular given the likely political sensitivity over the adverse effects on agriculture that the simulations predict.

What of the US withdrawal? Consider a scenario in which the TPP continues without US participation, and assuming that the other countries stick to the same terms that are in the agreement, with the exception that preferences are not extended to the US (as a non-member). We again present only long-run results in Table **??**, which can be compared with the corresponding columns of 1. The simulations indicate that the aggregate gains from the TPP would fall by close to 40 percent to $23 billion. Perhaps surprisingly, there are some winners among the TPP members; Australia benefits slightly from less competition, and Mexico benefits more substantially, presumably from less preference erosion (al-

though this depends on NAFTA remaining in its current form). The biggest winners by far, however, are non-TPP members, especially China, which, even leaving aside the broader political implications and looking simply at economic welfare, is much better off in a world in which the US is not part of the TPP. Which countries lose most substantially? Japan and Vietnam. The estimated gains to the former fall by nearly 60 percent, and for the latter by more than 80 percent. This further supports the Petri et al. (2014) hypothesis that the TPP would be most beneficial to those countries that do not already have an FTA with the US. The US also hurts itself – with a welfare loss of around $5.4 billion relative to the agreement as signed.See Kawasaki (2017) for some more early results on the effect of possible US withdrawal. His results, with large shocks to import augmenting technical change, suggest the US might still gain from NTM reductions within the TPP through a spillover effect.

### 3.5 Comparisons to Other Proposed Asia-Pacific "Mega-Regionals"

Given the level of attention now focused on proposals around the globe for "mega-regional" agreements, many of which are overlapping in terms of membership, it is not surprising that comparing the TPP with other proposed "mega-regionals," especially with the RCEP and the FTAAP in the Asia-Pacific region, has been another significant focus of the CGE literature.[22] The results of our own simulations of the possible welfare impact of the RCEP and the FTAAP are presented in Table 4. These are long-run estimates, assuming full liberalization in both cases. As such, they can be most directly compared with the corresponding values presented in Table 2.

Consider RCEP first. The key difference between RCEP and TPP is that the former includes China, Korea, India, and the remainder of ASEAN, while excluding the economies in the Americas. We see that RCEP is estimated to generate larger aggregate gains than the TPP, both for its members and the world as a whole, conditional on full liberalization of tariff barriers. The RCEP negotiations are still ongoing, but it is already clear that the degree of liberalization being targeted is substantially less than that embodied in the completed TPP agreement.[23] India in particular is reported to have consistently sought to limit the level of liberalization in RCEP. However insufficient information has emerged from the negotiations to enable predictions of the eventual outcome to be made with confidence.

Relative to the TPP, a fully liberalizing RCEP generates significantly larger welfare gains for Australia and Japan, and of course China, Korea and the remaining members of ASEAN, who are not part of the

[22] A number of comparisons to RCEP have been made (Cheong and Tongzon, 2013; Itakura and Lee, 2012; Kawasaki, 2014; Lee and Itakura, 2013; Lee and Itakura, 2014; Petri, 2013; Rahman and Ara, 2015), in addition to comparisons to the FTAAP (Itakura and Lee, 2012; Kawasaki, 2014; Lee and Itakura, 2013; Lee and Itakura, 2014; Petri et al., 2012; Petri, 2013). Itakura and Lee (2012) and Petri et al. (2012) also consider the East Asian Free Trade Area. The EAFTA was first proposed in 1999 as an FTA among the members of the then newly-formed ASEAN Plus 3 Group, which included China, Japan and Korea, but excluded Australia, New Zealand and India. The latter three countries were included in a parallel proposal for the CEPEA (Comprehensive Economic Partnership for East Asia), which emerged in 2005. The proposed RCEP effectively supersedes both the EAFTA and the CEPEA.

[23] A month after the 10th round of RCEP negotiations, the Heads of State of RCEP participating nations acknowledged that the end of 2015 deadline for conclusion of the RCEP agreement would not be met, and looked "forward to the conclusion of the RCEP negotiations in 2016."

TPP. Australia and Japan thus seem to benefit from less competition from the Americas. In the case of the former, this may well be a chimera, to the extent that it is due to preferential access in some sensitive products (such as rice) that may not be part of an actual agreement. On the other hand, the North and South American members of the TPP are, perhaps not surprisingly, worse off under the RCEP scenario, as is Vietnam, the latter due in part to the inclusion of China, which as we have seen generates more competition for Vietnam in textiles.

Given the membership of the RCEP, it is useful to compare it to an expanded TPP agreement including China and Korea. If we consider the results of the RCEP scenario relative to the 'possibles' scenario in Table **??**, we can see the importance of the trans-Pacific dimension of the TPP more clearly, since we don't mix the effects of excluding the Americas with the effects of expanding the TPP to include two major economies. In this comparison all of the Asian members of the TPP except Australia and Singapore are actually worse off under the RCEP scenario than under the expanded TPP scenario. Notably, the two economies that are not worse off are the two economies that signed FTAs with the US early (the agreement with Singapore coming into force in 2004, and the agreement with Australia one year later). Their losses are from preference erosion, and in the case of Australia, increased competition in agricultural export markets. Inclusion of the US is very important to a number of economies, including Japan (approximately a 20 percent increase in the gain over RCEP), and especially China (60 percent) and Vietnam (over 100 percent). The simulations also show it is important for Korea, but this is overstated given that the Korea-US FTA came into force in 2012 (i.e., one year after our base period).

Petri et al. (2014) observe similar patterns in their comparison of the TPP and RCEP. They note that the TPP favors countries that do not have an FTA with the US (i.e., Japan and Vietnam), while RCEP tends to favor the large East Asian economies (China, Japan and Korea). They also note, however, that the result is very much dependent on assuming effective coverage of the agreement among those three economies.[24] Cheong and Tongzon (2013) are similarly cautious, noting that the RCEP proposal may be too ambitious at this time. Rahman and Ara (2015) emphasize the potential for significant negative impacts on the smaller economies of South Asia. Itakura and Lee (2012) and Lee and Itakura (2014) consider the TPP and RCEP as part of a sequence of scenarios culminating in the FTAAP, and thus focus on questions surrounding the path (TPP-track vs Asia-track). Their key conclusion is that a larger number of countries are expected to realize welfare gains under the Asia-track than under the TPP-track. However, given the uncertainty about the establishment of an Asia-wide FTA, they conclude that the TPP-track is an attractive option for most countries in the Asia-Pacific region.

The FTAAP has in fact been promoted by APEC leaders as the potential result of convergence between the TPP and RCEP. An awkward complication yet to be resolved in these discussions is that

[24] Proposals and negotiations for a separate "CJK" (China-Japan-Korea) FTA have followed a tortuous path since 2011. Conclusion of a bilateral FTA between China and Korea in late 2014 appeared to trigger renewed interest in proceeding also with the CJK FTA, negotiations for which are reported to have resumed.

while the FTAAP is promoted within APEC as an APEC initiative, RCEP includes four participants that are not members of APEC (India, Cambodia, Laos and Myanmar). Analytically it is thus easier to model the FTAAP as an expansion of the TPP to include the remaining members of APEC, and our simulation of the FTAAP follows this approach. This can be viewed as broadly consistent with a US view (see Cheong and Tongzon, 2013) but not with an Asian view of the situation, and also begs the question of the degree of comprehensiveness that can be realistically expected in the FTAAP.[25]

The FTAAP would be a much larger agreement than the TPP, and consequently would result in much larger overall economic gains, assuming that it was comprehensive. Our estimates put the total welfare gains to FTAAP members at over 4.5 times those of the TPP. Kawasaki (2014), Lee and Itakura (2014) and Petri et al. (2012)) also indicate gains that are orders of magnitude larger. Relative to the TPP plus Korea and China, the impact of the FTAAP is more modest in aggregate terms, but has important implications for some of the ASEAN economies that may be left out of a TPP agreement. The estimated benefit to Thailand of completing the FTAAP, relative to a TPP agreement from which it is excluded, would be on the order of 3 percent of GDP, for example.

Another branch of the CGE literature looks at the potential effect of competing and overlapping agreements outside the region. In particular, Lee and Itakura (2013) has considered the TPP in relation to the TTIP (the Trans-Atlantic Trade and Investment Partnership linking the US and the EU), as have Disdier et al. (2016), Ganesh-Kumar and Chatterjee (2014) Thorensten and Ferraz (2014), and Rahman and Ara (2015). Lee and Itakura (2013) and Ganesh-Kumar and Chatterjee (2014) also consider the possibility of an EU-ASEAN agreement. The studies indicate relatively modest gains to the US and ASEAN economies from agreements with the EU, a result attributed to relatively low trade barriers, and, in the case of ASEAN relatively weak trade ties with the EU (Lee and Itakura, 2013). Disdier et al. (2016) find relatively little interaction between the TTIP and the TPP. Impacts on other countries in the region are also small in these studies, again reflecting limited trade ties between the EU and many economies in Asia, and hence limited trade diversion. This conclusion may be modified for countries with stronger trade ties to either the EU or the US. Ganesh-Kumar and Chatterjee (2014) find somewhat stronger effects of the TTIP than the TPP on India, for example.

### 3.6 Changes in Production Structure

While most of our discussion has focused on welfare impacts, these are not the only area of concern to policymakers, and are only one of the areas onto which CGE simulation may shed light. Indeed, underlying the sensitivity of agriculture that we discussed is concern that trade reform will lead to

[25]These and other issues related to the potential evolution towards, and eventual shape of the FTAAP are currently being analyzed by APEC members in a "collective strategic study" being undertaken as part of the "Beijing Roadmap". A possible target date of 2025 for completion of the FTAAP has been mentioned. While the FTAAP is being explored wholly within the APEC process and among APEC members, the "Beijing Roadmap" envisages that it would be negotiated and implemented outside the APEC process.

substantial reductions in agricultural output and employment, and of course incomes. Hence, we draw our survey to a close with a brief look at some of the production effects that have been found. In Table 5 we present the estimated long-run effects of the TPP on the structure of production in the TPP member economies.[26] The figures are for the actual liberalization scenario, and represent the estimated percentage change in the production quantity by sector.

In general, the estimated production effects are relatively small. We observe more structural change on average in the smaller economies, like Brunei and Vietnam, than in the larger economies like Japan and the US. On the manufacturing side the modest production shifts reflect relatively low initial protection levels. There are some large changes predicted, however. Production of textiles/apparel is estimated to increase by nearly 30 percent in Malaysia and nearly 50 percent in Vietnam. There is also some international rationalization of motor vehicle and transportation equipment production toward Japan, Singapore and Malaysia.

On the agricultural side, the limited adjustments reflect the severity of the TPP agreement carve-outs. A comparison of the results in Table 4 with the production effects of full liberalization among TPP members reveals similar effects in manufactures, but substantially reduced movements in agriculture, especially in Japan.[27] There is a clear link between the sensitivity of sectors and the estimated changes in the pattern of production. In Japan, for example, under full liberalization, there are projected output declines of greater than 10 percent in a number of agricultural products, including rice, wheat, dairy, and meat products. Indeed, many of the early Japanese studies emphasized this fact (Kagatsume and Tawa, 2012, Suzuki, 2012, Takamasu and Xi, 2012). The carve-outs eliminate most of this movement.

Of course, Japan is not alone in facing significant potential production adjustments in agriculture under a full liberalization scenario: there are also large declines in dairy output in Canada, which are largely eliminated by the carve-outs. There can also be significant implications for production patterns even for countries with a strong comparative advantage in agriculture. In New Zealand, for example, under full liberalization reductions are predicted in agricultural production levels across the board except in dairy, as resources are reallocated to take advantage of new market opportunities, while these adjustments are either absent or much less pronounced in the carve-out scenario shown in Table 5. In the US, there would be significantly higher rice production under full liberalization.

Could the particular sensitivities of Japanese agriculture have been addressed in less damaging ways? Lee and Itakura (2014) argue that domestic agricultural policy reforms in Japan would be required to avoid sharp reductions in output of agricultural and food products resulting from the TPP and other region-wide FTAs. They consider a scenario where such reforms result in a 1 percent per annum productivity increase in Japanese agriculture from 2016 to 2025, concurrent with the implementation of the

[26] While we have not presented the results here, the medium-term effects are quite similar. The long-run impact adds capital accumulation to the mix, which results in some Rybczynski-type resource reallocation, but the major shifts in the production pattern seem to be driven by the price effects.

[27] A copy of the table for production effects under full liberalization is available from the authors.

TPP. This is sufficient to largely eliminate substantial negative production effects, and perhaps even result in a competitive livestock and meat sector. Whittaker et al. (2013) reach a similar conclusion, and argue that other studies may be overstating the effect of trade reform on Japanese agricultural production. The key question is whether or not such productivity gains are likely to be realized: they conclude that full inclusion of the agricultural sector in TPP liberalization should trigger the reforms needed for the productivity gains to be realized.[28] Ultimately, there is no getting around the fact that there is a significant trade-off for Japan, and some other TPP members, between aggregate welfare gains from trade liberalization, and maintaining existing levels and patterns of agricultural production.

# 4 Concluding Comments

As a simulation technique, the results of any CGE study are entirely dependent on the set of assumptions that went into the modeling process. The results of CGE simulation exercises are subject to multiple uncertainties. Nonetheless, where similar patterns emerge from a large number of modeling exercises with different underlying assumptions, we gain confidence in the robustness of those patterns. Even where results diverge, we can relate the differences back to the underlying assumptions and gain an improved understanding of how different economic factors matter and why. We conclude with a few highlights of what we have learned from the simulations so far, including our own, and thoughts on the work that remains.

While a wide variety of model structures and simulation assumptions have been adopted in the literature to date, several consistent results do emerge. First, the studies consistently show that the total potential economic benefits from trade liberalization under the TPP are quite large, especially in the long run, and if NTBs are successfully minimized. We also know from the simulations that most members are likely to benefit from the TPP in the aggregate. However, the gains are not even. The studies consistently show that the largest gains in absolute value are accrue to Japan. When measured relative to economic size, the largest gains are consistently estimated to accrue to Vietnam and Malaysia. The pattern can be attributed to initial tariff levels (maintained and faced), the importance of trade in GDP, and strength of initial trade ties with TPP members.

Effects of the TPP on non-members are likely to be relatively mild. Non-members are hurt, through the processes of trade diversion and preference erosion, but there are only a few cases where the effects are large relative to GDP. The most notable examples are small countries with strong trade ties to TPP members, especially Thailand and the Philippines. These countries have a strong incentive to seek entry into the TPP in the future, or promote its eventual expansion to FTAAP. While an expansion of the TPP

[28] Lee and Itakura (2014) note the plans to phase out rice production controls and consolidate agricultural land, and other policy reforms, are expected to improve agricultural productivity, but it remains unclear how much reform will actually occur, and how much improved productivity will result. Japan has announced sharply increased financial support to their protected agricultural sectors since the TPP was signed.

membership is not imminent, it would have a substantial impact. In particular, expanding the agreement to include China and Korea would dramatically increase the benefits (perhaps double or more), although some current TPP members, such as Vietnam, would be hurt.

The TPP is one of several overlapping "mega-regional" agreements proposed in the region, and is seen by some as a possible pathway to an Asia-Pacific FTA (FTAAP). In general, the much broader liberalization under the FTAAP would generate gains an order of magnitude larger than the TPP, if the agreement was of similar quality. This is dependent in large part on successful trade reform among and between the major East Asian economies – Japan, Korea and China.

Does the exclusion of sensitive sectors matter? Yes, and perhaps quite a lot. In agriculture, liberalization for some products, notably rice and some dairy imports by Japan, sugar and some dairy imports by the US, and dairy and poultry imports by Canada, is largely limited to the provision of some additional quotas. Restricting agricultural trade dramatically cuts the estimated gains from the TPP, and is particularly harmful to Japanese households, as well as penalizing exporters in New Zealand and the US.

While much work has been done, much remains. There are many areas where CGE simulation can continue to make useful contributions to both the policy debates and to our understanding of the potential future economic outcomes. One immediate area for further analysis will be re-simulating the impacts of exclusions now that the scope of trade liberalization is better understood following the release of the agreement. More work on the understanding the implications and wisdom of the evolving US position is also a priority.

In addition, the work that has been completed so far has tended to focus on tariff cuts in goods, with only a few studies attempting to look at trade costs more broadly. Moreover, the TPP is a broad agreement and we are just beginning to come to grips with how it is going to affect services and investment. CGE simulation can definitely contribute to our understanding of these issues. Considerable work could also be done extending CGE models to areas that are of importance to policy but often sidelined by standard CGE modeling, such as the effect of trade reform on imbalances, as in the approach of Li and Whalley (2014) and Li et al. (2014).

Finally, almost all of the work that has been completed so far is at the global level of modeling, even when the questions of interest involve specific member economies. There is much more that could be done at the national level for the member countries by combining work with global models with more detailed national CGE models (as in Kagatsume and Tawa, 2012), or other modeling approaches. We can build more detailed pictures of expected changes in economic structure in TPP member economies, and address questions that are somewhat beyond the scope of most global trade models, such as detailed sectoral impacts, regional impacts, or the effect of the reforms on household income distribution.[29]

[29] Lawrence and Moran (2016) is a good example of what can be accomplished. Using the Petri and Plummer (2016) results on factor returns and product prices, they are able to make inferences on the effect of the TPP on income distribution in the US, finding small positive effects on income inequality.

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Table 1. Estimated Medium and Long Run Welfare Effects of TPP Liberalization with Tariff Elimination or Reductions and TRQ Expansions As Agreed

| | Medium Run | | | Long Run | | | |
|---|---|---|---|---|---|---|---|
| | % GDP[a] | EV[b] | TOT[c] | % GDP | EV | TOT | Capital[d] |
| Australia | -0.01 | -91 | -135 | 0.08 | 1,089 | -38 | 685 |
| New Zealand | 0.07 | 120 | 107 | 0.20 | 322 | 101 | 148 |
| Japan | 0.14 | 8,295 | 4,678 | 0.31 | 18,031 | 4,274 | 6,941 |
| Brunei | 0.64 | 107 | 8 | 1.83 | 306 | 2 | 173 |
| Malaysia | 0.24 | 689 | -462 | 1.57 | 4,534 | -1,415 | 3,839 |
| Singapore | 0.22 | 590 | 692 | 0.50 | 1,383 | 649 | 738 |
| Vietnam | 2.39 | 3,233 | 1,880 | 3.67 | 4,976 | 1,182 | 1,666 |
| Canada | 0.06 | 1,016 | 199 | 0.15 | 2,750 | 140 | 1,232 |
| USA | 0.00 | 715 | 611 | 0.02 | 2,786 | 952 | 1,255 |
| Mexico | -0.02 | -208 | -427 | 0.13 | 1,532 | -517 | 1,499 |
| Chile | 0.05 | 128 | 124 | 0.12 | 303 | 132 | 144 |
| Peru | -0.01 | -24 | -36 | 0.02 | 35 | -27 | 40 |
| China | -0.06 | -4,141 | -2,227 | -0.05 | -3,892 | -2,234 | 156 |
| Hong Kong | -0.04 | -111 | -105 | -0.04 | -101 | -63 | -31 |
| Korea | -0.06 | -698 | -536 | -0.08 | -964 | -429 | -309 |
| Taiwan | -0.07 | -323 | -235 | -0.07 | -343 | -199 | -57 |
| Rest of SE Asia | -0.15 | -103 | -64 | -0.15 | -107 | -44 | -25 |
| Indonesia | -0.05 | -457 | -362 | -0.02 | -202 | -251 | 111 |
| Laos | -0.03 | -2 | -1 | 0.07 | 6 | 3 | 2 |
| Philippines | -0.09 | -205 | -157 | -0.04 | -79 | -154 | 109 |
| Thailand | -0.34 | -1,161 | -931 | -0.39 | -1,351 | -725 | -345 |
| India | -0.03 | -632 | -330 | -0.04 | -800 | -359 | -125 |
| Brazil/Argentina | -0.02 | -464 | -372 | -0.02 | -595 | -284 | -159 |
| Rest of S America | -0.02 | -269 | -180 | -0.04 | -487 | -101 | -252 |
| Western Europe | -0.01 | -2,265 | -1,485 | -0.02 | -3,108 | -1,300 | -742 |
| Russia | 0.00 | 37 | -1 | 0.02 | 354 | 202 | 29 |
| Rest of World | -0.01 | -468 | -298 | 0.00 | 6 | 475 | -305 |
| TPP Members | | 14,569 | 7,240 | | 38,046 | 5,435 | 18,360 |
| TPP Non-Members | | -11,263 | | | -11,663 | | |
| World | | 3,307 | | | 26,384 | | |

[a] Equivalent variation as a percentage of baseline (2011) GDP.
[b] Equivalent variation measured in $US2011 millions.
[c] Terms of trade component of EV, measured in $US2011 millions.
[d] Capital accumulation component of EV, measured in $US2011 millions.

Table 2. Estimated Medium and Long Run Welfare Effects of the TPP with Full Tariff Liberalization

| | Medium Run | | | Long Run | | | |
|---|---|---|---|---|---|---|---|
| | % GDP[a] | EV[b] | TOT[c] | % GDP | EV | TOT | Capital[d] |
| Australia | 0.00 | 53 | 24 | 0.10 | 1,330 | 171 | 713 |
| New Zealand | 0.47 | 774 | 731 | 0.73 | 1,198 | 711 | 318 |
| Japan | 0.18 | 10,360 | 3,371 | 0.48 | 28,125 | 2,504 | 12,753 |
| Brunei | 0.65 | 108 | 10 | 1.86 | 310 | 5 | 174 |
| Malaysia | 0.25 | 715 | -439 | 1.58 | 4,577 | -1,376 | 3,837 |
| Singapore | 0.22 | 600 | 711 | 0.52 | 1,416 | 670 | 753 |
| Vietnam | 2.34 | 3,171 | 1,884 | 3.65 | 4,945 | 1,184 | 1,691 |
| Canada | 0.16 | 2,769 | -1,264 | 0.40 | 7,109 | -1,512 | 3,161 |
| USA | 0.02 | 3,728 | 3,053 | 0.04 | 6,940 | 3,507 | 1,995 |
| Mexico | -0.03 | -293 | -602 | 0.13 | 1,471 | -681 | 1,504 |
| Chile | 0.11 | 268 | 274 | 0.21 | 527 | 285 | 214 |
| Peru | -0.01 | -24 | -35 | 0.02 | 39 | -20 | 39 |
| China | -0.06 | -4,342 | -2,357 | -0.06 | -4,055 | -2,335 | 117 |
| Hong Kong | -0.03 | -79 | -70 | -0.01 | -27 | -30 | 9 |
| Korea | -0.07 | -785 | -576 | -0.09 | -1,142 | -458 | -394 |
| Taiwan | -0.07 | -320 | -237 | -0.07 | -313 | -191 | -47 |
| Rest of SE Asia | -0.14 | -100 | -61 | -0.15 | -101 | -40 | -24 |
| Indonesia | -0.05 | -460 | -354 | -0.02 | -192 | -217 | 96 |
| Laos | -0.01 | -1 | 0 | 0.10 | 8 | 4 | 3 |
| Philippines | -0.09 | -211 | -168 | -0.03 | -59 | -163 | 130 |
| Thailand | -0.37 | -1,287 | -1,046 | -0.41 | -1,434 | -834 | -316 |
| India | -0.04 | -661 | -333 | -0.05 | -919 | -384 | -182 |
| Brazil/Argentina | -0.02 | -527 | -424 | -0.02 | -675 | -318 | -186 |
| Rest of S America | -0.03 | -332 | -213 | -0.05 | -605 | -104 | -322 |
| Western Europe | -0.01 | -2,668 | -1,718 | -0.02 | -3,803 | -1,542 | -944 |
| Russia | 0.01 | 180 | 84 | 0.03 | 682 | 363 | 82 |
| Rest of World | -0.01 | -567 | -290 | 0.00 | -41 | 770 | -508 |
| TPP Members | | 22,227 | 7,719 | | 57,985 | 5,448 | 27,153 |
| TPP Non-Members | | -12,160 | | | -12,675 | | |
| World | | 10,067 | | | 45,310 | | |

[a] Equivalent variation as a percentage of baseline (2011) GDP.
[b] Equivalent variation measured in $US2011 millions.
[c] Terms of trade component of EV, measured in $US2011 millions.
[d] Capital accumulation component of EV, measured in $US2011 millions.

Table 3. Estimated Long Run Welfare Effects of TPP Expansion/Contraction

| | Probables[a] | | Possibles[b] | | No US | |
|---|---|---|---|---|---|---|
| | % GDP[c] | EV[d] | % GDP | EV | % GDP | EV |
| Australia | 0.24 | 3,297 | 0.37 | 5,149 | 0.08 | 1,106 |
| New Zealand | 0.36 | 587 | 0.46 | 759 | 0.16 | 266 |
| Japan | 0.39 | 23,299 | 0.79 | 46,518 | 0.21 | 12,480 |
| Brunei | 2.57 | 429 | 2.84 | 474 | 1.58 | 264 |
| Malaysia | 1.69 | 4,884 | 1.81 | 5,238 | 0.80 | 2,323 |
| Singapore | 0.58 | 1,597 | 1.11 | 3,047 | 0.47 | 1,300 |
| Vietnam | 5.01 | 6,796 | 2.91 | 3,939 | 0.62 | 847 |
| Canada | 0.16 | 2,869 | 0.23 | 4,010 | 0.14 | 2,458 |
| USA | 0.03 | 5,407 | 0.06 | 9,118 | -0.01 | -2,607 |
| Mexico | 0.22 | 2,523 | 0.58 | 6,737 | 0.18 | 2,107 |
| Chile | 0.18 | 461 | 0.19 | 470 | 0.11 | 291 |
| Peru | 0.06 | 102 | 0.05 | 88 | 0.02 | 31 |
| China | -0.08 | -5,708 | 0.46 | 33,740 | -0.02 | -1,570 |
| Hong Kong | 0.07 | 177 | -0.41 | -1,027 | -0.03 | -70 |
| Korea | 4.17 | 50,153 | 5.46 | 65,653 | -0.06 | -721 |
| Taiwan | -0.16 | -750 | 1.29 | 6,006 | -0.06 | -288 |
| Rest of SE Asia | -0.1 | -66 | -1.02 | -709 | -0.01 | -5 |
| Indonesia | -0.02 | -163 | 0.41 | 3,428 | -0.05 | -385 |
| Laos | 0.04 | 3 | -0.3 | -25 | 0.08 | 6 |
| Philippines | -0.03 | -63 | -0.43 | -953 | 0.00 | -5 |
| Thailand | -0.55 | -1,916 | -1.41 | -4,870 | -0.34 | -1,199 |
| India | -0.09 | -1,619 | -0.23 | -4,381 | -0.03 | -532 |
| Brazil/Argentina | -0.03 | -911 | -0.07 | -2,033 | -0.01 | -401 |
| Rest of S America | -0.03 | -343 | -0.16 | -2,068 | -0.01 | -76 |
| Western Europe | -0.04 | -7,246 | -0.1 | -18,555 | -0.01 | -1,801 |
| Russia | 0.11 | 2,301 | 0.13 | 2,760 | 0.01 | 242 |
| Rest of World | 0.08 | 4,945 | 0.09 | 6,168 | 0.01 | 551 |
| FTA Members[g] | | 102,403 | | 194,373 | | 23,472 |
| FTA Non-Members | | -11,360 | | -25,694 | | -8,862 |
| World | | 91,043 | | 168,680 | | 14,610 |

[a] Probables includes current TPP members plus Korea.
[b] Possibles includes probables plus China, Taiwan, and Indonesia.
[c] Equivalent variation as a percentage of baseline (2011) GDP.
[d] Equivalent variation measured in $US2011 millions.
[e] Including probables and possibles, respectively.

Table 4. Estimated Long Run Welfare Effects of RCEP and FTAAP Trade Liberalization

| | RCEP | | | | FTAAP | | | |
|---|---|---|---|---|---|---|---|---|
| | % GDP[a] | EV[b] | TOT[c] | Capital[d] | % GDP | EV | TOT | Capital |
| Australia | 0.55 | 7,680 | 3,669 | 2,154 | 0.40 | 5,525 | 2,201 | 1,827 |
| New Zealand | 0.63 | 1,037 | 481 | 357 | 1.03 | 1,689 | 873 | 532 |
| Japan | 0.84 | 49,740 | 15,302 | 19,258 | 1.09 | 64,334 | 15,398 | 25,873 |
| Brunei | 2.68 | 448 | 68 | 233 | 2.93 | 490 | 80 | 255 |
| Malaysia | 1.69 | 4,893 | -955 | 3,882 | 2.46 | 7,115 | -2,224 | 5,675 |
| Singapore | 1.64 | 4,482 | 2,338 | 2,201 | 1.52 | 4,161 | 2,159 | 2,120 |
| Vietnam | 1.39 | 1,886 | -596 | 1,454 | 3.27 | 4,436 | -551 | 2,482 |
| Canada | -0.01 | -168 | -98 | -124 | 0.52 | 9,201 | -1,520 | 4,116 |
| USA | -0.05 | -7,818 | -4,567 | -1,234 | 0.09 | 14,199 | 2,955 | 6,081 |
| Mexico | 0.03 | 378 | 14 | 117 | 0.64 | 7,478 | -2,101 | 6,339 |
| Chile | -0.04 | -92 | -51 | -87 | 0.29 | 732 | 201 | 390 |
| Peru | 0.04 | 70 | 44 | 12 | 0.04 | 64 | -98 | 57 |
| China | 0.16 | 11,822 | -2,643 | 5,431 | 0.50 | 36,313 | 661 | 14,640 |
| Hong Kong | -0.24 | -586 | -342 | -241 | 0.49 | 1,224 | 603 | 624 |
| Korea | 4.14 | 49,754 | -3,463 | 39,280 | 5.82 | 69,972 | -4,823 | 50,379 |
| Taiwan | -0.78 | -3,630 | -2,634 | -950 | 1.39 | 6,459 | 2,987 | 3,128 |
| Rest of SE Asia | -0.21 | -147 | -58 | -28 | -1.01 | -699 | -253 | -201 |
| Indonesia | 0.37 | 3,128 | 1,905 | 603 | 0.51 | 4,354 | 257 | 2,984 |
| Laos | 0.97 | 80 | -40 | 109 | -0.30 | -25 | -4 | -2 |
| Philippines | 0.19 | 433 | -210 | 508 | 0.97 | 2,167 | -667 | 2,408 |
| Thailand | 1.24 | 4,283 | -2,887 | 5,160 | 1.46 | 5,053 | -3,751 | 6,465 |
| India | 0.38 | 7,236 | -4,488 | 6,670 | -0.30 | -5,546 | -2,577 | -748 |
| Brazil/Argentina | -0.04 | -1,101 | -612 | -338 | -0.09 | -2,858 | -1,415 | -738 |
| Rest of S America | 0.01 | 117 | 179 | -18 | -0.18 | -2,418 | -514 | -1,160 |
| Western Europe | -0.08 | -14,534 | -6,460 | -3,786 | -0.16 | -29,345 | -12,709 | -7,283 |
| Russia | 0.12 | 2,509 | 1,209 | 64 | 0.82 | 17,629 | -709 | 8,689 |
| Rest of World | 0.08 | 5,140 | 4,671 | -57 | 0.05 | 3,253 | 5,289 | -1,406 |
| FTA Members[e,f] | | 146,902 | 8,481 | | | 262,594 | 11,931 | |
| FTA Non-Members | | -19,863 | | | | -37,638 | | |
| World | | 127,039 | | | | 224,955 | | |

[a] Equivalent variation as a percentage of baseline (2011) GDP.
[b] Equivalent variation measured in $US2011 millions.
[c] Terms of trade component of EV, measured in $US2011 millions.
[d] Capital accumulation component of EV, measured in $US2011 millions.
[e] RCEP members are Australia, New Zealand, Japan, China, Korea, Brunei, Malaysia, Singapore, Vietnam, Indonesia, Philippines, Thailand, Laos and India.
[f] FTAAP members are Australia, New Zealand, Japan, Brunei, Malaysia, Singapore, Vietnam, Canada, USA, Mexico, Chile, Peru, China, Hong Kong, Korea, Taiwan, Indonesia, Philippines, Thailand, and Russia

Table 5. Estimated Output Effects of TPP in the Long-Run (Percent Change in Production Volume)

| | Australia | New Zeal. | Japan | Brunei | Malaysia | Singap. | Vietnam | Canada | USA | Mexico | Chile | Peru |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paddy rice | 0.4 | 0.6 | -0.2 | 1.1 | -6.6 | -0.3 | 0.8 | 2.1 | -0.4 | 0.2 | 0.3 | 0.0 |
| Wheat | -0.4 | 0.4 | -4.0 | 1.8 | 4.3 | 3.6 | 1.5 | -0.4 | 0.1 | 0.4 | -0.9 | -0.3 |
| Vegetables and fruit | 0.4 | -0.9 | -2.4 | 0.3 | 0.7 | 0.8 | -1.6 | 15.2 | 0.0 | -0.3 | -1.1 | 0.1 |
| Oil seeds | 0.3 | -0.3 | -0.7 | 2.0 | 1.2 | 1.1 | -3.2 | -2.2 | -0.3 | 14.6 | -0.4 | 0.1 |
| Sugar cane and beet | 1.7 | -0.4 | 0.1 | 1.5 | 3.5 | 0.3 | 0.1 | 0.7 | -0.1 | -0.2 | 0.7 | 0.1 |
| Plat base fibers/wool | -0.4 | -0.6 | -0.3 | 2.9 | 5.5 | -0.3 | 20.3 | 0.1 | -0.8 | -0.2 | -0.8 | -4.0 |
| Other crops | -0.5 | 0.3 | -1.1 | -14.8 | -30.5 | -0.9 | -6.6 | -0.4 | 5.8 | -0.3 | -1.9 | 0.5 |
| Cattle | 5.2 | 1.7 | -5.9 | 1.7 | 6.1 | 0.7 | 2.9 | 0.8 | 0.4 | 0.2 | -0.8 | -0.1 |
| Other agriculture | -0.5 | -0.8 | -12.5 | 0.9 | 5.7 | 0.3 | 1.6 | 7.1 | 2.5 | 3.8 | 9.2 | -0.2 |
| Milk | 1.6 | 1.3 | -2.0 | 2.6 | 12.4 | 0.6 | -3.7 | -2.5 | 0.2 | -0.5 | 0.7 | 0.2 |
| Forestry | 0.3 | 0.1 | -0.3 | -2.1 | 2.7 | 0.6 | -6.6 | 0.2 | 0.0 | 0.2 | -0.3 | 0.1 |
| Fisheries | 0.3 | 0.2 | 0.2 | 0.7 | 0.9 | 0.3 | 0.7 | 0.3 | 0.2 | 0.2 | 0.2 | 0.0 |
| Coal, oil and gas | 0.3 | 0.0 | -0.5 | 0.9 | 0.1 | 0.3 | -0.9 | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 |
| Cattle meat | 7.4 | 2.1 | -6.6 | 1.4 | 5.7 | 0.5 | 1.1 | 1.2 | 0.3 | -0.4 | -0.9 | -0.4 |
| Other meat | -0.4 | -1.2 | -16.2 | 11.8 | 0.7 | -0.2 | -17.5 | 23.9 | 3.8 | 8.1 | 11.5 | -0.4 |
| Vegetable oils | 1.6 | 0.8 | 0.5 | 14.0 | 1.0 | 1.7 | -6.0 | -1.0 | 0.6 | -0.5 | -0.3 | 0.2 |
| Dairy | 2.3 | 1.6 | -1.2 | 67.9 | 12.4 | -1.9 | -4.6 | -3.0 | 0.3 | -0.6 | 0.3 | 0.3 |
| Processed rice | 0.4 | -0.6 | -0.1 | 0.1 | -7.8 | 0.1 | 1.2 | 0.5 | 0.3 | 0.0 | -0.2 | 0.0 |
| Sugar | 1.1 | -0.8 | 0.1 | 9.4 | 2.7 | 2.3 | 0.1 | 0.6 | -0.1 | -0.3 | 0.3 | 0.1 |
| Other food products | 0.9 | 0.0 | 0.4 | -21.9 | 8.8 | 12.7 | -2.2 | 0.8 | 0.6 | -0.1 | 0.6 | 0.1 |
| Textiles | 0.6 | 1.0 | 3.2 | 9.8 | 29.8 | 7.4 | 47.5 | -1.5 | -1.4 | -2.2 | -0.5 | -0.3 |
| Lumber | 0.2 | 2.2 | -0.8 | 0.6 | 4.1 | 5.0 | -8.3 | 0.2 | 0.0 | 0.3 | -0.7 | -0.1 |
| Paper | 0.3 | 0.1 | 0.2 | 1.7 | 1.1 | 7.6 | -1.4 | 0.1 | 0.1 | 0.2 | -0.3 | -0.1 |
| Chemicals | 0.3 | 0.3 | 0.5 | 1.2 | 5.1 | 2.7 | -0.3 | -0.1 | 0.0 | 0.2 | -0.1 | 0.0 |
| Metals | -0.1 | -0.6 | 1.3 | 1.7 | 1.5 | -4.2 | -1.5 | -0.3 | 0.0 | 0.2 | 0.0 | 0.4 |
| Fabricated metals | 0.1 | -0.3 | 0.3 | 1.5 | 4.8 | 4.4 | -4.1 | -0.1 | 0.0 | 0.3 | -0.1 | 0.0 |
| Motor vehicles | -10.4 | -7.3 | 3.9 | -11.6 | 2.2 | 6.2 | -0.8 | -0.4 | -0.2 | 0.4 | -0.5 | -0.7 |
| Other transport equipment | 0.5 | 0.6 | -0.8 | 4.5 | 6.9 | 0.8 | -3.0 | 0.2 | 0.0 | 0.5 | -0.5 | 0.2 |
| Electrical equipment | 0.5 | -0.7 | -0.9 | -5.6 | 2.6 | -0.4 | -4.2 | -0.3 | 0.0 | 0.8 | -0.6 | -0.7 |
| Other machinery | 0.7 | -1.0 | -0.7 | 1.6 | 7.1 | 0.3 | -3.7 | -0.2 | 0.0 | 0.5 | -0.6 | 0.0 |
| Other manufactures | 0.4 | -0.2 | 0.7 | 6.1 | 1.4 | 3.8 | 1.1 | 0.0 | 0.2 | -0.3 | -0.5 | -0.2 |
| Services | 0.1 | 0.1 | 0.3 | 1.8 | 2.2 | 0.1 | 4.5 | 0.1 | 0.0 | 0.2 | 0.1 | 0.1 |

Table 6. Summary of CGE Studies of the TPP

| Study | Model Details | Simulation Details | Selected Results |
|---|---|---|---|
| This study | GTAP, GTAP9 data (2011 base year), 27 regions × 32 commodities, modified agricultural elasticities in Japan, steady state closure. | TPP tariff liberalization following actual agreement, TRQ expansions, expansion to possible new members, comparison with RCEP and FTAAP. | Welfare gains in region of $14 to $40 billion, substantial reduction in welfare relative to complete liberalization. |
| Akgul et al. (2015) | Modified GTAP with firm heterogeneity. GTAP8 data (2007 base year), 3 regions × 2 commodities. | Elimination of Japanese tariffs on US exports. | Significant increase in variety and quantity of US exports to Japan as a result of a decrease in the export productivity threshold. |
| Areerat et al. (2012) | GTAP, GTAP7 data (2004 base year), 17 regions × 15 sectors, with focus on agricultural products. | TPP among seven members (Australia, Chile, Peru, New Zealand, USA, Singapore and Vietnam), plus Japan, Korea and China separately and in groups. All tariffs to zero. | Overall gains from TPP around $14 billion (including Japan). Inclusion of Japan very important to US gains. Some significant production shifts, especially in agriculture. |
| Bi et al. (2013) | GTAP, GTAP8 data (2007 base year), 23 regions × 19 commodities. | TPP10 (no Japan or Canada), TPP including Japan, Canada and Korea. Tariff and NTB cuts, magnitudes not specified. | China hurt by the TPP, especially through effect on textiles industry, although real GDP effects are small. |
| Burfisher et al. (2014) | GTAP, GTAP8.1 data (2007 base year), 12 regions × 29 commodities with heavy focus on agriculture. | Baseline projection to 2025, then elimination of all agricultural tariffs and TRQs on intra-TPP trade. | Small macroeconomic gains for most countries, but a large increase in agricultural trade (around $8.5 billion in total), driven by import expansion in Japan in rice and beef. |
| Cabinet Secretariat (2015) | GTAP, GTAP9 data (2011 base year) with 12 regions and 27 sectors identified. Positive feedback from openness to productivity and an elastic labor supply are built into the model. | TPP with tariff reduction based on actual agreement. NTBs are assumed to be lowered such that the difference in the Logistic Performance Index (World Bank) with Singapore is halved. | Increase in Japan's real GDP by 2.6%. Labor supply and capital stock increase by 1.3% and 2.9%, respectively. |
| Cheong and Tongzon (2013) | GTAPDyn, GTAP8 data (2007 base year), 18 regions × 5 commodities. Tariff adjusted for existing agreements. | Baseline path to 2027, then elimination of all tariffs among TPP members. RCEP with and without Japan/China. | Small gains with few exceptions (NZ, Malaysia). Gains under RCEP much larger. Both cause net damage to global economy. |
| Ciuriak and Xiao (2014) | Modified GTAP, dynamic with services and FDI. GTAP8 data (2007 base year), 18 regions × 57 commodities. | Baseline path to 2035, full liberalization among TPP members, and 'best guess'. Adjustments for preference under-utilization, NTBs, services/FDI reform. | Total welfare gains $74-166 billion, driven mostly by NTB reductions and services. |

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Table 6 – *Continued from previous page*

| Study | Model Details | Simulation Details | Selected Results |
|---|---|---|---|
| Ciuriak et al. (2016) | See Ciuriak and Xiao (2014). Data updated to GTAP9. 40 regions × 33 commodities. | Trade effects less than half previous estimates. Welfare gain around $30 billion. | |
| Cororaton and Orden (2015) | PEP model, competitive Armington model with dynamics. GTAP8 data (2007 base year), 20 regions × 15 commodities. Adjustments to NTBs. | Baseline to 2024, TPP scenario 90% tariff reduction, 20% NTB reduction, extension to include Philippines. | Welfare gains range from 0.05% of GDP (USA) to 2.7% (Vietnam), rising slightly with inclusion. Philippines, Thailand and Indonesia most hurt by exclusion. |
| Disdier et al. (2016) | MIRAGE model, GTAP8.1 data (2007 base year), 24 regions × 31 commodities. Adjustments to both tariffs and NTBs. | Baseline to 2025, TPP scenario full tariff reduction, expansion to NTMs and other economies incl. China and India, with and without TTIP. | Welfare gains small. US agrifood trade expands at expense of other countries, little interaction between TTIP and TPP, TTIP outcomes sensitive to NTB assumptions. |
| Durongkaveroj et al. (2014) | GTAP, GTAP8 data (2007 base year), aggregation not stated. No adjustments. | TPP among 12 members, full tariff liberalization, then with 0-50% reduction in agriculture. Expansion to Thailand. | Small GDP gains to Thailand from joining. Hurt by staying out, especially if agricultural reform successful. |
| Ganesh-Kumar and Chatterjee (2014) | GTAP, GTAP8.1 data (2007 base year), 13 regions × 10 commodities. POVCAL used to assess poverty impacts on India. | TPP among 12 members, full liberalization including export subsidies, TTIP and EU-ASEAN on same basis. | India hurt by all of the agreements, especially through changes in textiles trade. Effects small, more in TTIP than TPP. Poverty and inequality worsens. |
| Itakura and Lee (2012) | GTAPDyn, GTAP7.1 data (2004 base year), 22 regions × 29 commodities. Adjustments made for NTB equivalents in services. | Baseline to 2030, formation of FTAAP via TPP track (including Korea), or via expansion ASEAN through EAFTA and CEPEA. Tariffs reduced to zero, NTBs in services reduced by 25%. | Welfare gains from 0.4% of GDP (USA) to 5.5% (Vietnam). Larger gains under FTAAP, and for East and Southeast Asia from taking 'Asian' path rather than 'TPP' path. No significant differences in output responses. |
| Kagatsume and Tawa (2012) | Monash-MRF model (Armington model with dynamics), based on 2005 Japanese inter-regional IO table. 8 Japanese regions × 7 sectors. | TPP as elimination of all tariffs, unilateral tariff reduction in 2012. | Agricultural production falls from the benchmark case of continuous annual growth of 2% by between 0.3 and 2.2%. The impacts vary across different regions of Japan. |

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| Study | Model Details | Simulation Details | Selected Results |
|---|---|---|---|
| Kawasaki (2014) | GTAP, GTAP8.1 data (2007 base year), 31 regions × 29 commodities, macroeconomic data projected to 2010, steady state closure. | Baseline projection to 2010, then simulations of RCEP, TPP and FTAAP. All tariffs to zero, and with NTBs modeled via import-augmenting technical change. | Total welfare gains $94-449 billion, driven mostly by assumed productivity gains in import technology. Large absolute gains to US under NTB assumption. Still larger gains under both RCEP and FTAAP. |
| Kawasaki (2017) | GTAP, GTAP9 data (2011 base year), aggregation not reported. | TPP, TPP without the US (plus others). Tariff cuts based on agreement and large NTM cuts. | Real GDP gains of 1.95% overall from TPP tariffs and NTMs. Falls to 1.25 without US. US might still gain from NTM spillovers. |
| Lee and Itakura (2013) | GTAPDyn, GTAP8 data (2007 base year), 22 regions × 32 commodities. Adjustments made for NTB equivalents in services. | Baseline to 2030, formation of FTAAP via TPP track or via RCEP track and both. Extension to include Korea, Thailand, Indonesia and Philippines in TPP. Tariffs eliminated, NTBs in services reduced by 25%, 20% improvement in import technology. | Welfare gains ranging from 0.2% of GDP (USA) to 2.1% (Vietnam). Expansion generates strong benefits, especially for Thailand. Larger gains under FTAAP. Some preference erosion effects when TTIP included. |
| Lee and Itakura (2014) | GTAPDyn, GTAP8.1 data (2007 base year), 22 regions × 32 commodities. Adjustments made for NTB equivalents in services. | Baseline to 2030, formation of FTAAP via TPP (with Korea) track or via RCEP track. Same assumptions as Lee and Itakura (2013) except rice excluded. Productivity increases in Japanese agriculture of 1% per annum. | Slightly smaller welfare gains than in Lee and Itakura (2013) for Japan. Improvements in productivity modestly increase welfare gain to Japan, but result in much lower agricultural production contractions. |
| Li et al. (2014) | Armington model with money and generalized trade costs, 13 regions × 2 sectors (traded and non-traded). 2011 base year. | TPP with China and various other agreements involving China (including RCEP and CJK) all as elimination of all tariffs among members, and elimination of tariffs plus NTBs cut by 25% and 50%. | Small gains from tariff reform, with most benefits to China. Gains larger and more evenly distributed across members when NTBs considered. Small improvement in US trade imbalance when TPP includes China. |
| Li and Whalley (2014) | Armington model with money and generalized trade costs, 11 regions × 2 sectors (traded and non-traded). 2011 base year. | TPP (not including Japan) as elimination of only tariffs, tariffs plus 50% cut in NTBs, and elimination of all trade costs, with and without China. | Small gains from tariff elimination, larger gains if NTBs cut or eliminated (up to 4% of GDP some members). Adding China benefits most other TPP economies. |

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| Study | Model Details | Simulation Details | Selected Results |
|---|---|---|---|
| Li (2014) | Armington model with recursive dynamics, GTAP8 data (2007 base year), 27 regions (including SEZs in China and Mexico) × 41 commodities. | Baseline to 2018, TPP with and without China, complete elimination of all tariffs. | Real income gains from 0.3% (Australia/New Zealand) to 9% (Vietnam). Introduction of China benefits most countries, excluding Vietnam. |
| Li and Yao (2014) | GTAP, GTAP8 data (2007 base year), 8 regions × 41 commodities. | TPP as elimination of all tariffs, with and without China. | China joining the TPP has small benefits for China and TPP members (measured in terms of real GDP), excluding Vietnam. |
| Lu (2015) | GTAP, GTAP8 data (2007 base year), 10 regions × 3 commodities (textiles, apparel and others). | TPP as elimination of tariffs in textiles and apparel only. Participation by Canada/Mexico and Japan separated. | TPP results in a significant decline in textiles/apparel exports of China ($1.9 billion), especially with Japan. |
| Narayanan and Sharma (2016) | GTAP, GTAP8.1 data (2007 base year) projected to 2011 including tariff adjustments, 16 regions × 18 commodities. Closure allows for unemployment of labor. | TPP as elimination of all tariffs, plus expansion to include Korea, China and India (in steps). | Total welfare gain of $150 billion, dominated by Japan and US, expands to $475 billion with China and Korea. India is hurt. Would benefit marginally from inclusion, but effects on agriculture may limit appeal. |
| Nguyen et al. (2015) | GTAP, GTAP9 data (2011 base year), 23 regions × 22 sectors, with focus on livestock products. Adjustments made for NTB equivalents in services. | TPP as complete removal of tariffs, plus scenarios with 7% reductions in service NTBs and additional adjustments for trade facilitation (intra-TPP and assumed to spillover to multilaterally). | Largest proportional welfare gains from TPP to Vietnam ($5.6 to 7.4 billion). TPP is superior to RCEP for Vietnam. Large gains in investment. Exports to TPP countries expand significantly in the apparel sectors. |
| Oduncu et al. (2014) | GTAP, GTAP7 data (2004 base year), aggregation not specified. | TPP as full removal of tariffs, plus various concomitant trade cost reduction scenarios. FTAAP on same basis. | TPP reduces export value of Turkey by 0.1 to 0.5%, impact of FTAAP 3-6 times larger. |
| Petri et al. (2012) | Recursive dynamic Armington model with monopolistic competition in manufactures and private services, and firm heterogeneity. GTAP8 data (2007 base year), 24 regions × 18 sectors. | Baseline to 2025, including existing agreements. TPP9 then expansion to TPP13, FTAAP via TPP and EAFTA, TPP with sensitive products excluded. Simulations include tariffs and NTBs, with cuts based on 'best guess' and adjusted for tariff utilization rates, and costs of meeting ROOs. | Welfare (EV) gains of $130 billon (including Korea). Largest gains to Japan (absolute) and Vietnam (relative). Larger gains from completing move to FTAAP. Rises in exports in region of $300 billion. Significant reduction in benefits if sensitive products excluded. |

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| Study | Model Details | Simulation Details | Selected Results |
|---|---|---|---|
| Petri (2013) | See Petri et al. (2012). | TPP12, extension to Korea, RCEP and FTAAP. Baseline and cuts to tariffs and NTBs estimated based on previous agreements as in Petri et al. (2012). | Total welfare gain of $285 billion. Extension to Korea adds $90 billion. Gains from RCEP and FTAAP considerably larger, but dependent on China-India-Japan-Korea component. Trade diversion minimal. |
| Petri and Plummer (2016) | See Petri et al. (2012) for model structure. Data is updated to GTAP9 (base year 2011), with 29 regions × 19 sectors. | Baseline to 2030, including existing FTAs. TPP based on actual agreement's tariffs cuts. Adjustments for NTBs (more conservative than Petri et al., 2012), tariff utilization, and ROOs. NTB cuts spillover to non-members. | Total gains in range of $312 to $525 billion, with $465 the base projection. Largest absolute gains to the US, with substantial gains to Japan, Malaysia and Vietnam. Some increase in US job churn. |
| Petri et al. (2013) | See Petri et al. (2012). | Extension of TPP to include Japan and Korea, then Indonesia, Korea, Philippines and Thailand (TPP16). Baseline and cuts to tariffs and NTBs as in Petri et al. (2012). | Adding Japan to TPP causes preference erosion for Mexico. Adding Korea benefits all members. Gains from TPP16 accrue mostly to emerging ASEAN economies. |
| Petri et al. (2014) | See Petri et al. (2012). | Extension of TPP to include China, Indonesia, Korea, Philippines and Thailand. Baseline and cuts to tariffs and NTBs as in Petri et al. (2012). | Expansion to include China dramatically expands benefits of TPP (to over $2 trillion) under assumption of high quality agreement. Absolute gains dominated by China. |
| Rahman and Ara (2015) | GTAP, GTAP8 data (2007 base year), 17 regions × 10 commodities. | TTIP, RCEP, TPP, expansion of TPP to include South Asia, all as elimination of tariffs. | Total welfare gains around $11 billion. Moderate welfare losses to South Asian economies, driven by agriculture and textiles. |
| Strutt et al. (2015) | GTAPDyn, GTAP8.1 data (2007 base year), 21 regions × 31 commodities. | Baseline to 2030, accounting for existing agreements. Tariff reductions vary across countries in terms of depth, phase-in and exclusions. Expansion of TRQs in dairy. Separate scenario with trade facilitation, services liberalization and NTBs. | Welfare gains to NZ ranging from $371 million to $1.8 billion (tariffs plus NTBs). Growth in exports between 0.4 and 2.2 percent, esp. in meats and processed foods. Dairy smaller despite strong comparative advantage due to limited liberalization. |

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| Study | Model Details | Simulation Details | Selected Results |
|---|---|---|---|
| Roh and Oh (2016) | Custom model with firm heterogeneity. GTAP9 data (base year 2011), 5 regions × 3 commodities. | TPP with and without Korea. Shock structure not specified. | Modest welfare increase for Korea, larger when firm heterogeneity effect included. Substantial fall in economic welfare with Korean entry for TPP members that already have an agreement with Korea. |
| Suzuki (2012) | GTAP, GTAP7.1 data (2004 base year), 13 regions × 25 commodities. | TPP (excluding Canada) with all tariffs are eliminated, with sensitive sectors of Japan excluded, and with sensitive sectors of all TPP members excluded. | In the first scenario, Japan's rice imports increase dramatically, its rice production falls by 68%. GDP of Australia and New Zealand fall if sensitive sectors are excluded. |
| Takamasu and Xi (2012) | GTAP, GTAP7 data (2004 base year), 13 regions × 14 commodities. | TPP (excluding Mexico and Canada), expansion to include China, expansion to include China, Korea, Taiwan and the remaining ASEAN economies. | Japan's GDP modestly increases by 0.3-0.4%. Devastating effects on the agricultural sector in Japan (rice production, for example, falls by 64.5-83.7%.). |
| Thorensten and Ferraz (2014) | GTAP, GTAP8 data (2007 base year), 57 commodities. Regional aggregation not specified. | TTIP and TPP, expansion to include China. Full tariff reform, full tariff reform plus 50% NTB cuts. | Estimated falls in Brazilian exports ranging from 0.4% (tariffs only, no China), to 5% (tariffs and NTBs, including China). |
| USITC (2016) | GTAP model (recursive dynamic). GTAP9 data (base year 2011), projected to 2017 (incl. updated tariff data), 19 regions × 56 sectors. Labor supply responses. Additional simulations using GTAP-FDI model (26 regions × 59 sectors). | Baseline to 2047. TPP scenario based on actual agreement (tariff reductions as per schedule, TRQ expansions with some exceptions, services as removal of AVEs). Potential FDI effects modeled through productivity shocks using GTAP-FDI. | Real income gains to US of $57 billion by 2032. Largest component merchandise trade, then services. Expansion of total exports by 1% (approx. 19% to new partners). Small expansion of overall employment. Output expansions in agriculture and services, contractions in manufacturing. |
| Whittaker et al. (2013) | GTAP, GTAP8 data (2007 base year), data projected to 2020, 26 regions × 31 commodities, modifications to agricultural elasticities in Japan, steady state closure. | Baseline projection to 2020. TPP as elimination of all tariffs, plus productivity shocks to selected agricultural sectors in Japan. | Tariff reform reduces Japanese agricultural and food processing output (esp. rice, meat and dairy). Modest productivity gains can mitigate, and even lead to increased production/exports in niche markets. |